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# OCR A Level

Computer  
Science

H446 – Paper 2

1

## The IDE and programming basics

Unit 11

Programming  
techniques



**PG ONLINE**

# Objectives

- Be familiar with the use of an IDE to develop and debug a program
- Define what is meant by an algorithm and pseudocode
- Learn how and when different data types are used
- Learn the basic arithmetic operations available in a typical programming language
- Write pseudocode solutions to simple problems

# Facilities of an IDE

- An IDE (Integrated Development Environment) is software which enables you to enter, edit, compile (or interpret) and run your programs
- Many IDEs will also have debugging facilities to help you find the logic errors in a program
  - Why type your program in an IDE rather than a text editor?

# Entering a program in an IDE

AN IDE can offer many features specifically designed to make entering program code as easy and quick as possible

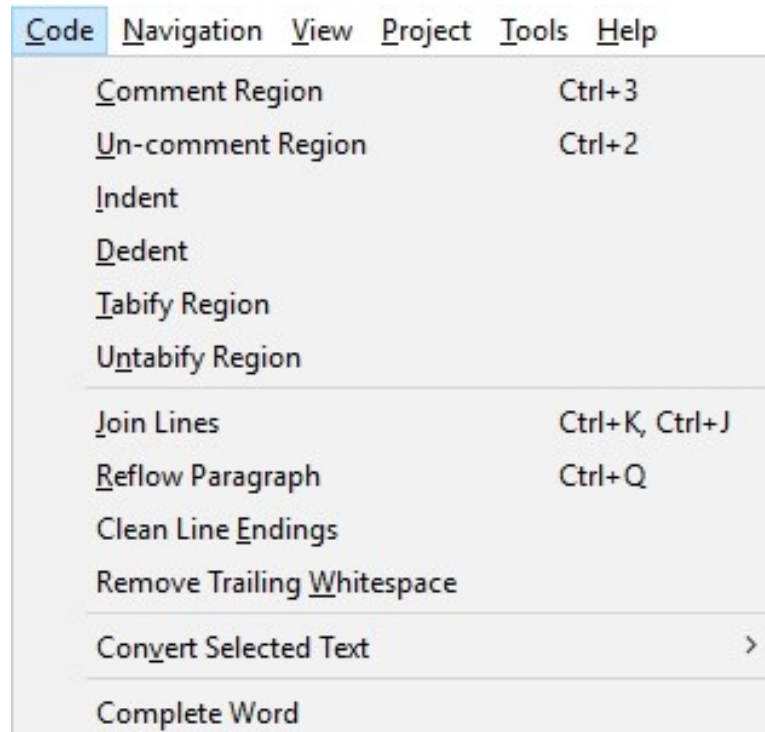
- add line numbers
- automatically indent code
- auto-complete commands
- comment or un-comment a region





# Typical IDE options

- Here are some of the menu options when entering program code in the IDE Komodo Edit:



# Finding syntax errors

- When you interpret or compile a program, syntax errors will be reported:

```
3      a = 5
4      b = 10
5      c = 6
6      answer1 = a + b * c
7      print ("answer1 =" answer1)
8      answer2 = (a + b) * c
9      print ("answer2 =", answer2)
```

line 7

```
      print ("answer1 =" answer1)
                        ^
```

SyntaxError: invalid syntax



# Finding logic errors

- Once you have corrected all the syntax errors, your program may still not run

```
3      a = 5
4      b = 10
5      c = "6"
6      answer1 = a + b * c
7      print ("answer1 =", answer1)
8      answer2 = (a + b) * c
9      print ("answer2 =", answer2)
```

```
line 6, in <module>
```

```
    answer1 = a + b * c
```

```
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```



# Debugging facilities

- Logic errors can be hard to find
- Many IDEs provide debugging facilities
  - Set a **breakpoint** in the program which will cause the program to stop on that line
  - Set a **watch** on a variable so that its value is displayed each time it changes
  - **Step through** a program one line at a time
  - **Trace** the execution of a program – for example display a message every time a particular statement is executed or subroutine is called





# Worksheet 1

- Try **Task 1** on the worksheet



# Algorithms

- An algorithm is a sequence of instructions that can be followed to solve a problem
- For example, suppose you want to calculate the amount of paint needed to paint a room



# Problem: calculate paint required

- What inputs would you need?
- What decisions does the painter need to make?
- Think out the sequence of instructions, starting with

Input the dimensions of the room

- Use statements like

Input, Calculate, Output,  
Add, Subtract, Multiply

- Or maths symbols like  $+$ ,  $-$ ,  $*$  (multiply)



# Worksheet 1

- Complete **Task 2** of the Worksheet





# Pseudocode

- Pseudocode is used to write instructions in statements that are somewhere between English and a programming language
- There are guidelines for writing pseudocode, but no strict rules
- They are an aid to thinking out the steps needed before you start to code
- Once you have written the pseudocode, the coding should be a breeze!





# Pseudocode statements

- Assignment statements are written using an = sign
- The symbols +, -, \*, /, \*\* (exponentiation) are used for common arithmetic operations

miles = currentMileage - previousMileage

count = count + 1

- Input and output statement are written

currentMileage = input ("Enter current mileage")

print ("You have travelled ", miles, "miles")



# Pseudocode statements

- What do the following statements do?
  1. `number = input ("Enter a number")`
  2. `number = number + 1`
  3. `print ("The number is : ", number)`



# Pseudocode

- Compare pseudocode and Visual Basic
  - What is happening?
  - What is the advantage of using pseudocode?

```
number = 0
number = input("Enter
number")

if number > 4 then
    print("Greater than 4")
else
    print("4 or less")
endif
```

```
Dim number As Integer = 0
Console.Write("Enter number")
number = Console.ReadLine()
If number > 4 Then
    Console.WriteLine("Greater than
4")
Else
    Console.WriteLine("4 or less")
End If
```

# Pseudocode

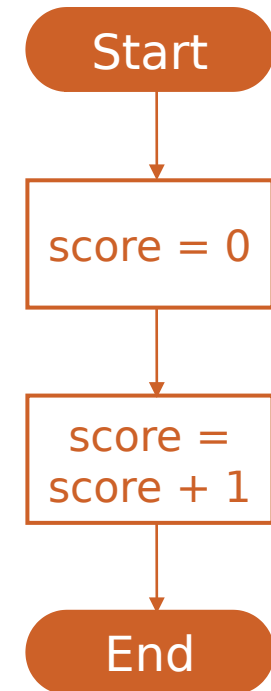
- What is the purpose of pseudocode?
- What guidelines would you suggest for writing clear, understandable pseudocode?

```
number = 0
number = input ("Enter number:
")
if number > 4 then
    print ("Greater than 4")
else
    print ("4 or less")
endif
```



# Variables and assignment

- An **identifier** is a name, e.g. **score**, that points to a memory location
- **Assignment** is assigning a value to the memory location
- In this example **score** is assigned the value of **0**
- In the next line, **1** is added to **score** and the result is again assigned to **score**





# Data types

- Here are some variable declarations in VISUAL BASIC

- What does each line do?

```
1. Dim wholeNumber As Integer =  
   5
```

```
2. Dim height As Decimal = 1.5
```

```
3. Dim name As String = "Bob"
```

```
4. Dim choice As Char = "a"
```

```
5. Dim validData As Boolean =
```

- In Python, a variable doesn't have to be explicitly declared as a particular data type
- It happens when you assign data to the variable



# Data types

- What happens if the character “9” is assigned to an integer variable?
- What are the allowable values of a Boolean data type?

```
1. Dim wholeNumber As Integer =  
   5  
2. Dim height As Decimal = 1.5  
3. Dim name As String = "Bob"  
4. Dim choice As Char = "a"  
5. Dim validData As Boolean =  
   False
```

# Variables and Constants

- The value of a **variable** can be changed while the program is running
- To change the value of a **constant**, you have to change it in the source code and then recompile
- A constant cannot be the target of an assignment

```
Dim name as String = "Robert"  
Const VAT as Single = 17.5
```

```
Console.WriteLine("VAT is: " & VAT)  
name = "Hazel"  
Console.WriteLine("Name is: " &  
name)
```

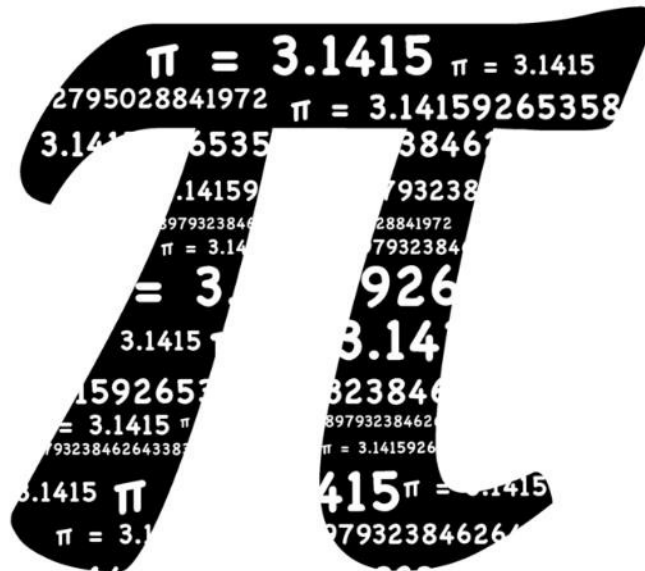
```
VAT = 20  
error
```

this will cause an



# Why use a constant?

- Constants reduce the risk of errors by reducing access to the memory location
  - Would you declare 3.14159265359 as a variable or a constant?



# Worksheet 1

- Complete **Task 3** of the Worksheet





# The mod and div operators

- The operator **mod** is used to find the remainder in integer division
- **div** returns the integer part of the division

$x = 17 \text{ mod } 3$       sets  $x = 2$

$y = 17 \text{ div } 3$       sets  $y = 5$



# The mod and div operators

Calculate the following:

1.  $8 \bmod 8$
2.  $8 \operatorname{div} 8$
3.  $10 \bmod 8$
4.  $10 \operatorname{div} 8$



# String handling functions

- Programming languages have a number of built-in string handling functions or methods
- For example:

```
name = "Robert "
```

```
x = len(name)  returns the length of string name
```

```
x = name.find("be")  determines if "be" occurs in  
string name
```

*(returns the position of the first character in the string, 0 if not found)*



# String handling functions

- What would the following return?  
(Assume the index starts at 0)

```
name = "John"
```

```
x = len(name)
```

```
x = name.find("be")
```

```
x = name.find("oh")
```



# String handling

- What values will be assigned to the variables?
  - (A string is indexed from 0)
  - What type are the variables?

```
Dim name As String = "Robert"
```

```
'Retrieves element 1 and assigns it to letter
```

```
letter = name.Substring(1)
```

```
'Third element in the name string
```

```
thirdChar = name(3)
```

```
'Assigns elements 1 to 3 in name to answer
```

```
answer1 = name.Substring(1,3)
```

```
'Determines if start of string matches the search
```

```
string answer2 = name.StartsWith("Ro")
```

```
answer3 = name.StartsWith("Jo")
```





# Worksheet 1

- Now try the questions in **Task 4** of the worksheet, and the extension task if you have time



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